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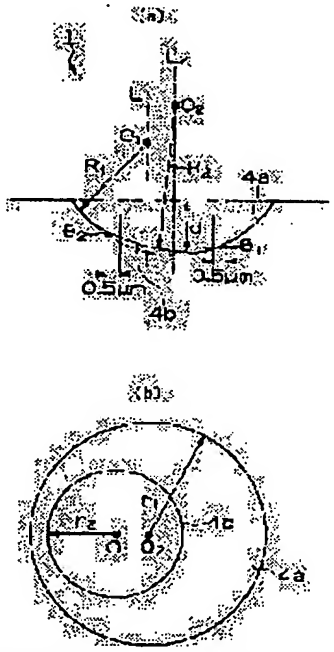
## (54) REFLECTOR AND REFLECTION TYPE LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a reflector having proper directivity in which a high reflection efficiency can be obtained in a wide angle range and to provide a reflection type liquid crystal display device having the display screen having both of a wide visibility angle and enough brightness around the direction as the center where the user usually observes the display screen.
SOLUTION: The reflector 1 has a large number of recesses 4 formed on the surface, and the inner face of each recess 4 consists of a continuous face of a peripheral curved face 4a and a bottom curved face 4b surrounded by the peripheral curved face 4a, both being a part of two respective spheres having different radii. The radius of the sphere forming the peripheral curved face 4a is smaller than the radius of the sphere forming the bottom curved face 4b, and the normal lines on the respective centers of the spheres to the reflector surface are present on different straight lines. The reflection type liquid crystal display device is equipped with this reflector 1.

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CLAIMS

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[Claim(s)]

[Claim 1] Many crevices are formed in a reflector front face, and the inside of the aforementioned crevice consists of a field which the periphery curved surface which are a part of two spherical surfaces from which a radius differs respectively, and the bottom curved surface which consists in the position surrounded by the periphery curved surface were made to follow. The reflector characterized by the normal stood to the reflector front face from the center of each spherical surface consisting on a mutually different straight line while the radius of the spherical surface which forms a periphery curved surface is smaller than the radius of the spherical surface which forms a bottom curved surface.

[Claim 2] the reflector according to claim 1 characterized by for the normal stood to the reflector front face having had the interval of the range of 0.1-10 micrometers, and having estranged from the center of the spherical surface of each above

[Claim 3] The reflector according to claim 1 or 2 characterized by being set up respectively in the range whose tilt angles of the aforementioned bottom curved surface are 4 - 17 degrees, and -17—4 degree in the range whose tilt angles of the aforementioned periphery curved surface are 10 - 35 degrees, and -35—10 degree.

[Claim 4] A reflector given in either of a claim 1 to the claims 3 characterized by forming the depth of the crevice of aforementioned a large number at random 0.1 or in 3 micrometers.

[Claim 5] A reflector given in either of a claim 1 to the claims 4 characterized by forming the crevice of aforementioned a large number continuously mutually.

[Claim 6] A reflector given in either of a claim 1 to the claims 4 characterized by forming the crevice of aforementioned a large number in a reflector front face with many slots.

[Claim 7] The reflected type liquid crystal display characterized by equipping either of a claim 1 to the claims 6 with the reflector of a publication.

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[Translation done.]

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the reflector which can be used suitable for the reflected type liquid crystal display which uses an extraneous light as the light source, and the reflected type liquid crystal display using this. While having a latus angle of visibility by using the reflector which can raise a reflection factor especially in the reflective direction of the range of desired, and its reflector while having a good reflection factor in more detail covering a wide range angle, in the usual visual field range of the display built into specific equipment like a notebook sized personal computer, it is related with the reflected type liquid crystal display which has moderate directivity so that sufficient luminosity can be secured.
[0002]
[Description of the Prior Art] In recent years, as displays, such as a handicap type computer, since especially power consumption is small, the reflected type liquid crystal display which uses an extraneous light as the light source is used widely. This reflected type liquid crystal display reflects in a screen side the light which carried out incidence from the screen side by the internal reflector, and a user enables it to view the display shown according to the state of the molecular arrangement of a liquid crystal layer.
[0003] Although a very high reflection factor is shown in the specific degree of angle of reflection corresponding to the degree of incident angle when the reflector by which the front face was made the flat mirror-plane state is used as a reflector used for this kind of reflected type liquid crystal display, the range of the degree of angle of reflection with a high reflection factor has very narrowly the property that an angle of visibility is narrow. Therefore, the attempt from which a reflection factor good in a wide range direction is obtained is made by forming in a reflector front face many the crevices and slots which make a part of spherical surface, or preparing random irregularity (Japanese Patent Application No. No. 203637 [ nine to ], Japanese Patent Application No. No. 197576 [ nine to ], Japanese Patent Application No. No. 194643 [ nine to ], etc.).
[0004] Among these, as what established the crevice of a large number which make a part of spherical surface in the reflector front face, the reflector as shown in drawing 8 is proposed by Japanese Patent Application No. No. 203637 [ nine to ]. The reflector 51 of the gestalt shown in this drawing is continuously formed in the front face of the plate-like resin base material 53. (base material for reflectors) which consists of a photopolymer layer prepared on the substrate 52 which consists of glass etc. so that many crevices 54 where the inside makes a part of spherical surface may overlap, and the reflective film 55 which consists of thin films, such as aluminum and silver, is formed of vacuum evaporationo or printing on it.
[0005] The above-mentioned crevice 54 is arranged at random in the adjoining pitch 5 of a crevice 54 or the range of 50 micrometers while the depth is formed at random 0.1 or in 3 micrometers. Moreover, the inside of a crevice 54 is the curved surface which makes a part of single spherical surface respectively, and the tilt angle is set as -18 or the range of +18 degrees.
[0006] In addition, the above-mentioned "depth of a crevice" is the distance between the centers of the crevice which becomes circular [ the pitch ] when plane view of the distance from a reflector front face to the pars basilaris ossis occipitalis of a crevice and the "pitch of an adjoining crevice" is carried out. Moreover, as it is indicated in drawing 9 as "the tilt angle of a crevice inside", when the range with minute 0.5-micrometer width of face is taken in the arbitrary parts of the inside of a crevice 54, it is the thing [ as opposed to / the level surface of the slant face of minute within the limits / a thing ] of an angle theta. The positive/negative of an angle theta defines the slant face of positive and left-hand side for the slant face of the right-hand side in drawing 8 as negative as opposed to the normal stood to the reflector front face.
[0007] This reflector 51 has the reflection property as shown in beta of drawing 5 . Drawing 5 is a graph which shows the reflection property curve to which made the vertical axis into the reflection factor (reflectivity), and it made the horizontal axis the degree of angle of reflection in the 30 degrees of incident angle. In addition, as it is indicated in drawing 10 as the degree of incident angle, they are the normal H stood to reflector 51 front face, and the angle omega 0 which an incident light J makes. Moreover, the degree of angle of reflection is the angle omega which the above-mentioned normal H and the reflected light K make on the flat surface containing the above-mentioned normal H and an incident light J. As shown in beta of drawing 5 , focusing on the 30 degrees of angle of reflection, the range of a reflector 51 is 15 degrees <= omega<=45 degrees, and it has the to some extent good reflection factor.
[0008]
[Problem(s) to be Solved by the Invention] The reflection factor with a good grade with which the conventional reflector 51 mentioned above is crossed to the comparatively wide range angle by existence of a crevice is obtained. However, as shown in beta of drawing 5 , the comparatively high field of reflectivity exists in the bilateral symmetry focusing on the 30 degrees of angle of reflection as the 15 degrees of angle of reflection, and a peak of 45 right and left.
[0009] However, although it changes also with the degree of the inclination of the screen, or positions of the light source, the display built into the equipment which uses the screen, making it slanting like the personal computer of a note type is seen in many cases from the direction near the normal over the screen generally, as shown in drawing 11 . Drawing 11 is drawing explaining the state of using the notebook sized personal computer which has a main part 61 and a lid 62, and display 63 is formed in the inside of a lid 61. As for a normal and Q, in drawing 11 , an incident light and omega 0 are the degrees of incident angle (for example, 30 degrees). [ as opposed to display 63 in P ] Moreover, the reflected light with the degree omega 0 of angle of reflection smaller [ the reflected light with the degree omega 0 of angle of reflection and the degree omega of incident angle equal / R1 / and R2 ] than the degree omega of incident angle and R3 are the reflected lights with the larger degree omega 0 of angle of reflection than the degree omega of incident angle.

[0010] A user's visual axis is concentrated in the direction of the reflected light R2 usually near Normal P so that he can understand from drawing. On the other hand, the reflected light R3 is hard to try to serve as a direction which looks up at display 63 from the bottom. therefore, considering the facilities of use of a user, to secure a latus angle of visibility, simultaneously to make higher the reflection factor of the direction where the degree of angle of reflection is small are desired
[0011] On the contrary, like a table type game machine, when seeing the display on the level surface, as shown in drawing 12 , it sees in many cases from the direction near the direction which is generally parallel to the screen. Drawing 12 is drawing explaining the busy condition of the display 73 prepared horizontally on a table 72. As for a normal and S, in drawing 12 , an incident light and omega 0 are the degrees of incident angle (for example, 30 degrees). [ as opposed to display 73 in W ] Moreover, the reflected light with the degree omega 0 of angle of reflection smaller [ the reflected light with the degree omega 0 of angle of reflection and the degree omega of incident angle equal / T1 / and T2 ] than the degree omega of incident angle and T3 are the reflected lights with the larger degree omega 0 of angle of reflection than the degree omega of incident angle.
[0012] A user's visual axis is concentrated in the direction of the reflected light T3 with the usually larger degree of angle of reflection than the reflected light T1 so that he can understand from drawing. On the other hand, the reflected light T2 is hard to try to serve as a direction which looks into display 73 from a top. therefore, considering the facilities of use of a user, to secure a latus angle of visibility, simultaneously to make higher the reflection factor of the direction where the degree of angle of reflection is large are desired
[0013] While it is made in order that this invention may solve the above-mentioned problem, and having a good reflection factor covering a wide range angle While the degree of angle of reflection (a negative value is included), the large degree of angle of reflection, etc. smaller than the degree of incident angle have a latus angle of visibility by using the reflector which can raise the reflection factor of the direction of desired preponderantly, and its reflector Slant, when you use it, leveling, let it be a technical problem to offer the reflected type liquid crystal display which has moderate directivity to the usual visual field range [ in / a specific operating condition / for the screen ].
[0014]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, many crevices are formed in a reflector front face as invention of a claim 1. The inside of the aforementioned crevice consists of a field which the periphery curved surface which are a part of two spherical surfaces from which a radius differs respectively, and the bottom curved surface which consists in the position surrounded by the periphery curved surface were made to follow. While the radius of the spherical surface which forms a periphery curved surface is smaller than the radius of the spherical surface which forms a bottom curved surface, the reflector characterized by the normal stood to the reflector front face from the center of each spherical surface consisting on a mutually different straight line is offered.
[0015] Since a tilt angle with it is obtained according to this reflector, the angle of visibility of sufficient size is obtained. [ the small radius of the spherical surface which forms a periphery curved surface and ] [ wide range ] Moreover, since the bottom curved surface which exists in the position [ core / of a crevice ] shifted a little serves as a curve near a flat surface, in the inside of a crevice, the distribution of a specific tilt angle becomes high, consequently the reflection factor in the degree of angle of reflection of a small larger or direction than the degree of incident angle becomes the highest, and a nearby reflection factor also becomes high with a peak of the direction.
[0016] In this case, a thing [ like and the normal stood to the reflector front face having had the interval of the range of 0.1-10 micrometers, and having estranged from the center of each spherical surface, ] according to claim 2 is desirable. This is because it becomes impossible to take out moderate directivity when smaller than 0.1 micrometers, and the reflectivity of regular reflection will become remarkably small if larger than 10 micrometers. In addition, the difference with the degree of angle of reflection to which the degree of incident angle and a reflection factor become the highest becomes large, so that the clearance from each normal is large.
[0017] Moreover, about like and a periphery curved surface, it is the range of 10 - 35 degrees, and -35—10 degree, and the tilt angle of the inside of each crevice has a desirable thing [ considering as the range of 4 - 17 degrees and -17—4 degree ] according to claim 3 about a bottom curved surface. This is because the reflection factor of a certain specific direction does not become sufficiently high, when the tilt angle of the reflected light will spread too much, reflectivity will fall, if the tilt angle of a periphery curved surface exceeds the range which are 10 - 35 degrees, and -35—10 degree, and the tilt angle of a bottom curved surface exceeds the range which are 4 - 17 degrees, and -17—4 degree.
[0018] Moreover, as for the depth of each crevice, it is desirable to form in a claim 4 at random 0.1 or in 3 micrometers like a publication. This is because regular reflection will become strong too much if smaller than 0.1 micrometers, the front face of heights cannot finish burying by the flattening film when carrying out flattening of the crevice like backward, if 3 micrometers is exceeded, and a desired reflection property is no longer obtained. Moreover, it is because there is fault that regularity will arise, the interference color of light will come out, and the reflected light will color when the depth is not made random but it is only the crevice of the fixed depth.
[0019] In addition, the above-mentioned "depth of a crevice" is the distance from a reflector front face to the pars basilaris ossis occipitalis of a crevice as mentioned above. Moreover, "the tilt angle of a crevice inside" is a thing [ as opposed to / the level surface of the slant face of minute within the limits / a thing ] of an angle theta, when the range with minute 0.5-micrometer width of face is taken in the arbitrary parts of the inside of a crevice, as explained using drawing 9 . The positive/negative of an angle theta defines the slant face of positive and left-hand side for the slant face of the right-hand side in drawing 8 as negative as opposed to the normal stood to the reflector front face.
[0020] About arrangement of each crevice, although you may make it estrange mutually, a thing [ forming continuously mutually / like ] according to claim 5 is desirable. The effect of extending an angle of visibility can demonstrate to the maximum extent, maintaining moderate directivity by the crevice by this, since a crevice can be efficiently arranged all over a reflector front face.
[0021] Moreover, as other arrangement, many crevices can also be formed in a reflector front face with many slots like a publication at a claim 6. Thereby, in addition to the above-mentioned effect by the crevice, it can have the effect of extending the angle of visibility of a direction perpendicular to a slot by the slot. In this case, the shape of a straight-line top or a curve has as a slot, and even if it crosses at arbitrary angles mutually, it does not interfere. Moreover, a crevice and a slot shall be respectively formed by the density of the range in which a mutual effect is not lost.
[0022] From the above-mentioned claim 1 as invention of a claim 7 to moreover, the claim 6 The reflected type liquid crystal display characterized by equipping either with the reflector of a publication is offered. In addition, as an installation mode of a reflector, it is good also as which a type the external type installed in the outside of a liquid crystal cell, or built-in installed in the inside of the substrate which constitutes a liquid crystal cell.

[0023] This reflection type liquid crystal display is equipped with moderate directivity while it has a latus angle of visibility. Therefore, when it includes in specific equipments, such as a notebook sized personal computer, the usual visual field range of a user is covered, and sufficient luminosity can be secured.
[0024]
[Embodiments of the Invention] Hereafter, the gestalt of 1 operation of this invention is explained with reference to drawing 1 or drawing 5 . Drawing 1 is drawing showing the reflector of the gestalt of this operation. As shown in this drawing, the reflector 1 of the gestalt of this operation On for example, the front face of the plate-like resin base material 3 (base material for reflectors) which consists of a photopolymer layer prepared on the substrate 2 which consists of glass etc. It is continuously formed so that the crevices 4 of a large number which make the specific configuration which the inside shows to drawing 2 may overlap, and the reflective film 5 which consists of thin films, such as aluminum and silver, is formed of vacuum evaporationo or printing on it.
[0025] Drawing 2 (a) is the cross section of a crevice 4, and drawing 2 (b) is a plan. As shown in this drawing, the inside of each crevice 4 is looked like [ the position surrounded by periphery curved-surface 4a and periphery curved-surface 4a ], and is formed from certain bottom curved-surface 4b. Periphery curved-surface 4a sets a center to O1, and is a part of spherical surface whose radius is R1. Moreover, bottom curved-surface 4b sets a center to O2, and is a part of spherical surface whose radius is R2. From O1 and O2 which are the center of each spherical surface, the normal stood to the front face of a reflector 1 is respectively located on the separate straight line L1 and L2.
[0026] Each radii R1 and R2 have the relation of R1<R2, and it changes in the range of 1<=70 micrometers of 10 micrometer<=R, and 2<=100 micrometers of 20 micrometer<=R. Moreover, in drawing 2 (a), theta 1 is the tilt angle of periphery curved-surface 4a, and changes in 10 degree<=theta1 <=35 degree and -35 degree<=theta1 <=-10 degree. Moreover, theta 2 is the tilt angle of bottom curved-surface 4b, and changes in 4 degree<=theta2 <=17 degree and -17 degree<=theta2 <=-4 degree.
[0027] In addition, the radius r1 of seen periphery curved-surface 4a and the radius r2 of bottom curved-surface 4b are decided according to each radius, R1 and R2, and tilt angles theta1 and theta2 from a flat surface.
[0028] Depth d of a crevice 4 takes a random value for every crevice 0.1 or in 3 micrometers. It is because regular reflection will become strong too much if the summit of heights cannot finish burying by the flattening film, desired flat nature is no longer obtained and 0.1 micrometers is not fulfilled, when carrying out flattening of the crevice 4 at a back process, if the depth of a crevice 4 exceeds 3 micrometers.
[0029] Again, it returns to drawing 1 and arrangement of a crevice 4 etc. is explained. The pitch of the adjoining crevice 4 is arranged at random 5 or in 50 micrometers. It is because there is fault that the interference color of light will come out and the reflected light will color when regularity is in the pitch of the crevice 4 which adjoins temporarily. Moreover, it is because the problem of that only the configuration where a desired reflection property is obtained cannot be formed, an interference light occurring that there are restrictions on manufacture of the matrix for reflector formation, and floor to floor time becomes very long arises when the pitch of the adjoining crevice 4 is less than 5 micrometers. Moreover, it is desirable to set the pitch of the adjoining crevice 4 to 5 or 50 micrometers from a practical viewpoint in the case of using the diamond indenter which can be used for manufacture of the matrix for reflector formation.
[0030] Although there is especially no limitation in the manufacture method of the reflector of the above-mentioned composition, it can manufacture as follows, for example. First, as shown in drawing 3 (a), the plate-like matrix base material 7 with the flat front face which consists of brass, stainless steel, tool steel, etc. is fixed on the table of rolling equipment. And if a nose of cam presses the front face of the matrix base material 7 by the diamond indenter 8 of the specific configuration corresponding to the crevice 4 shown in drawing 2 and the matrix base material 7 is moved horizontally, by repeating operation of moving the diamond indenter 8 up and down and pressing many times, crevice 7a of a large number from which the depth and an array pitch differ is rolled on the front face of the matrix base material 7, and it considers as the matrix 9 for reflector formation as shown in drawing 3 (b).
[0031] As shown in drawing 4 , the rolling equipment used here has the function which the table which fixes the matrix base material 7 moves in the direction of X in the level surface, and the direction of Y with the resolution of 0.1 micrometers, and moves in the perpendicular direction (Z direction) with the resolution whose diamond indenter 8 is 1 micrometer. And the depth of each crevice is changed by the pitch of the crevice which adjoins by changing the travel of the direction of X and the direction of Y changing the travel of a Z direction. In addition, the portion of a path R2 swerves from a medial axis, the nose of cam of the diamond indenter 8 is formed, and the portion of a path R1 is formed in mist or the upper part from it.
[0032] Then, as shown in drawing 3 (c), contain and arrange a matrix 9 in the enclosed-type container 10, and the resin material 11, such as silicone, is slushed into a container 10. It is made to leave and harden in ordinary temperature, this hardened resin product is picked out from a container 10, an unnecessary portion is excised, and as shown in drawing 3 (d), imprinted type 12 which has **** 12a with the crevice of a large number which make **** of a matrix 9, and the heights of a large number which have the shape of reverse toothing is created.
[0033] Next, photopolymer liquid, such as an acrylic resist, a polystyrene system resist, an azide rubber system resist, and an imido ** resist, is applied to the upper surface of a glass substrate by the applying methods, such as the spin coat method, screen printing, and a blasting method. And after an application end, prebaking which heats the photopolymer liquid on a substrate 1 minute or more by the 80-100-degree C temperature requirement using heating apparatus, such as a heating furnace or a hot plate, is performed, and the photopolymer layer as a resin base material 3 is formed on a substrate. However, since prebaking conditions change with kinds of photopolymer to be used, of course, you may process in the temperature and time besides the above-mentioned range. In addition, as for the thickness of the photopolymer layer formed here, it is desirable to consider as the range of 2-5 micrometers.
[0034] Then, as shown in drawing 2 (e), after forcing **** 12a of this imprinted type 12 on the resin base material 3 on a glass substrate fixed time using imprinted type 12 shown in drawing 2 (d), imprinted type 12 is removed from the resin base material 3. Thus, as shown in drawing 2 (f), the heights of imprinted type type side 12a are imprinted on the front face of the resin base material 3, and many crevices 4 are formed in it. Moreover, it is desirable to choose the value which suited the kind of resin base material 3 which carries out die pressing, and which press ** at the time uses, for example, it is 30 - 50 kg/cm2. Considering as the pressure which is a grade is good. It is desirable to choose the value which suited the kind of resin base material 3 used also about press time, for example, it considers as time to be 30 seconds - about 10 minutes.
[0035] Then, beams of light, such as ultraviolet rays for stiffening the resin base material 3 from the rear-face side of a transparent glass substrate, are irradiated, and the resin base material 3 is stiffened. In the case of the resin base material 3 which consists of a photopolymer layer of the above-mentioned kind, beams of light, such as ultraviolet rays irradiated here, are 50 mJ/cm2. Although it is enough to stiffen the resin base material 3 if it is the above intensity, of course depending on the kind

of photopolymer layer, you may irradiate by intensity other than this. And the postbake which heats the resin base material 3 on a glass substrate 1 minute or more at about 240 degrees C using heating apparatus, such as heating furnace same with having used by prebaking and a hot plate, is performed, and the resin base material 3 on a glass substrate is calcinated.
[0036] The reflector 1 of the gestalt of this operation is completed by forming aluminum on the front face of the resin base material 3 by EB vacuum evaporationo etc., and finally, forming the reflective film 1 in it along the front face of a crevice.
[0037] alpha of drawing 5 is [ in / the 30 degrees of incident angle (incidence from the direction of the right-hand side in drawing 2 ) / reflector / of the gestalt of this operation / 1 ] / a graph which shows the reflection property curve to which made the vertical axis into the reflection factor (reflectivity), and it made the horizontal axis the degree of angle of reflection. Thus, in the reflector 1 of the gestalt of this operation, since periphery curved-surface 4a which becomes the inside of a crevice 4 from a part of spherical surface with a small radius exists and the range of a tilt angle with a comparatively large absolute value is given, it has the good reflection factor in the latus range of 15 degrees <= omega<=45 degrees. Moreover, since bottom curved-surface 4b which consists of a part of spherical surface with a large radius, i.e., the curved surface near a flat side, is unevenly distributed, the rate of the inside which gives the tilt angle of the specific range becomes high. Consequently, from 30 degrees which is the degree of incident angle, and the 30 object degrees of angle of reflection of a direction, the reflection factor in the small degree of angle of reflection becomes the highest, and the nearby reflection factor is also high with a peak of the direction. As compared with the reflector 51 concerning the conventional technology, the reflection factor in the 20 degrees of angle of reflection is high 10% or more.
[0038] Moreover, although not illustrated, when incidence is carried out from the direction of the left of drawing 2 , from 30 degrees which is the degree of incident angle, and the 30 object degrees of angle of reflection of a direction, the reflection factor in the large degree of angle of reflection becomes the highest, and a nearby reflection factor also becomes high with a peak of the direction.
[0039] In addition, when the quantity of light of the whole reflected light of the reflector of this invention and the reflector of the conventional technology is measured, a significant difference does not exist in both. Although it seems to the direction of alpha that the whole quantity of light is large when the reflection properties alpha and beta of drawing 5 are compared, this is because it is difficult to arrange the conditions in comparative experiments strictly.
[0040] The diamond indenter 8 and the matrix base material 7 seem moreover, according to the above-mentioned manufacture method, not to rub, since the diamond indenter 8 is moved up and down and the front face of the matrix base material 7 is only pressed, in case the matrix 9 for reflector formation is manufactured. Consequently, if the surface state at diamond indenter 8 nose of cam is imprinted certainly at a matrix 9 side and makes the nose of cam of an indenter 8 the mirror-plane state, the crevice inside of a matrix 9, as a result the crevice inside of a reflector can also be easily made into a mirror-plane state.
[0041] Furthermore, as compared with the method of forming a concavo-convex side by heating resin films, such as polyester, all the surface states of sizes, such as the depth of a crevice, a path, and a pitch, and a crevice inside etc. are controlled, and can create the crevice configuration of a reflector mostly by use of highly precise rolling equipment as a design. Therefore, according to this method, it becomes what reflection properties, such as the degree of angle of reflection of the reflector to create and reflective efficiency, tend to control, and a desired reflector can be obtained.
[0042] In addition, it does not pass over the rolling pattern of the crevice shown in drawing 3 as the above-mentioned manufacture method to a mere example, but, of course, a design change is possible suitably. Moreover, it can change suitably also about the material of various base materials, such as a base material for reflectors, and a base material for matrices, an imprinted type component, etc.
[0043] Drawing 6 is drawing showing the reflector of the gestalt of other operations of this invention. As shown in this drawing, the reflector 31 of the gestalt of this operation The stripe slot 34 is formed in the front face of the plate-like resin base material 33 (base material for reflectors) which consists of a photopolymer layer prepared on the substrate 32 which consists of glass etc. for example, subsequently The crevice 35 of a large number which make a specific configuration is formed at random, and the reflective film 36 which consists of thin films, such as aluminum and silver, is formed of vacuum evaporationo or printing on it.

[0044] Here, the crevice 35 is the same as the crevice 4 shown in drawing 2 , and the inside is looked like [ the position surrounded by the periphery curved surface which is a part of spherical surface respectively, and the periphery curved surface ], and is formed from a certain bottom curved surface. It is the same as various conditions, such as a point of being located on a straight line with the same normal stood to the front face of a reflector 31, also indicated the aforementioned crevice 4 from the relation between the radius of a periphery curved surface, and the radius of a bottom curved surface, and the center of each spherical surface.
[0045] According to this operation gestalt, it can have the effect of extending the angle of visibility of a crevice and extending the angle of visibility of a direction perpendicular to a slot by the slot in addition to the above-mentioned effect that it can have moderate directivity.
[0046] Next, the reflected type liquid crystal display of the STN (Super Twisted Nematic) method equipped with the above-mentioned reflector is explained. As shown in drawing 7 , the liquid crystal layer 15 is formed between the display side glass substrate 13 of a couple with a thickness of 0.7mm, and the tooth-back side glass substrate 14, and this reflected type liquid crystal display forms one phase contrast board 16 which is from polycarbonate resin, a polyarylate resin, etc. on the upper surface side of the display side glass substrate 13, and is arranging the 1st polarizing plate 17 in the upper surface side of the phase contrast board 16 further. Moreover, the reflector 1 of the gestalt of this operation shown in the 2nd polarizing plate 18 and drawing 1 is formed in the inferior-surface-of-tongue side of the tooth-back side glass substrate 14 one by one.
[0047] A reflector 1 is attached so that the field which formed the crevice 4 in the undersurface side of the 2nd polarizing plate 18 may counter, and it fills up with the viscous element 19 which consists of material which does not have a bad influence on rates of an optical refraction, such as a glycerol, between the 2nd polarizing plate 18 and the reflector 1. The transparent-electrode layers 20 and 21 which are from ITO (indium stannic-acid ghost) etc. on the opposed face side of both the glass substrates 13 and 14 are formed, respectively, and the transparent-electrode layer 20 and the orientation films 22 and 23 which consist of polyimide resin etc. on 21 are formed, respectively. The liquid crystal in the liquid crystal layer 15 serves as arrangement twisted 240 degrees by the relation of these orientation film 22 and 23 grades.
[0048] Moreover, it is made to carry out by forming the light filter which is not illustrated by printing etc. between the aforementioned tooth-back side glass substrate 14 and the transparent-electrode layer 21 color display of this liquid crystal display.
[0049] In the liquid crystal display of the gestalt of this operation, since reflector 1 the very thing combines the high reflection

factor covering the degree of latus angle of reflection, and moderate directivity as mentioned above, a user can consider as the screen which combines a latus angle of visibility and sufficient luminosity centering on the direction which looks at the screen to usual.

[0050] In addition, although the reflected type liquid crystal display of the gestalt of this operation explained the example which arranges a reflector in the outside of the 2nd polarizing plate and which is made into the so-called external reflector, it arranges in the opposed face side of a tooth-back side glass substrate, and is good also as built-in. Moreover, although it is the thing of a STN method as an example of a liquid crystal display and being explained, of course, the reflector of this invention can be applied also to the liquid crystal display of TN (Twisted Nematic) method which set the torsion angle of the liquid crystal molecule of a liquid crystal layer as 90 degrees.

[0051]

[Effect of the Invention] As explained to the detail above, it sets to the reflector of this invention. While the radius of the spherical surface which consists of a field which the periphery curved surface which are a part of two spherical surfaces from which a radius differs an inside respectively, and the bottom curved surface which consists in the position surrounded by the periphery curved surface were made to follow, and forms a periphery curved surface is smaller than the radius of the spherical surface which forms a bottom curved surface It can also have moderate directivity, while a good reflection factor is obtained to the wide range degree of angle of reflection by having formed in the front face many crevices where it was made for the normal stood to the reflector front face from the center of each spherical surface to consist on a mutually different straight line. Moreover, according to the reflected type liquid crystal display of this invention, the liquid crystal display equipped with sufficient luminosity centering on the direction which a user wishes a latus angle of visibility is realizable by having had the reflector with the above outstanding properties.

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[Translation done.]

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram showing the reflector which is the gestalt of 1 operation of this invention.
[Drawing 2] The crevice 4 of a **** reflector is shown, (a) is a cross section and (b) is a plan.
[Drawing 3] It is the process-flow view having shown order for the manufacture process of a **** reflector later on.
[Drawing 4] It is drawing showing the manufacture process of the matrix used for formation of a **** reflector, and is drawing showing the state where the matrix base material is pressed by the diamond indenter.
[Drawing 5] It is comparison data of a **** reflector and the conventional reflection property of a reflective pair.
[Drawing 6] It is the perspective diagram showing the reflector which is the gestalt of other operations of this invention.
[Drawing 7] It is the cross section showing the reflected type liquid crystal display which is the gestalt of 1 operation of this invention.
[Drawing 8] It is the perspective diagram showing an example of the conventional reflector.
[Drawing 9] It is drawing for explaining the tilt angle of the crevice inside of a reflector.
[Drawing 10] It is drawing for explaining the degree of incident angle, and the degree of angle of reflection.
[Drawing 11] It is drawing for explaining the busy condition of the display prepared in the notebook sized personal computer.
[Drawing 12] It is drawing explaining the busy condition of the display prepared horizontally.
[Description of Notations]
1 Reflector
2 Substrate
3 Resin Base Material (Base Material for Reflectors)
4 Crevice
4a Periphery curved surface
4b Bottom curved surface
5 Reflective Film
7 Matrix Base Material
8 Diamond Indenter
9 Matrix for Reflector Formation
12 Imprinted Type

[Translation done.]

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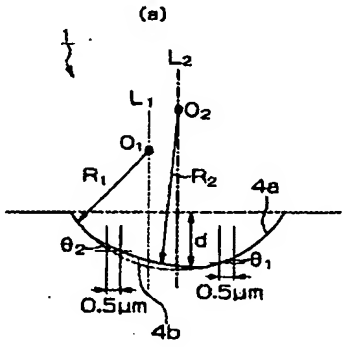
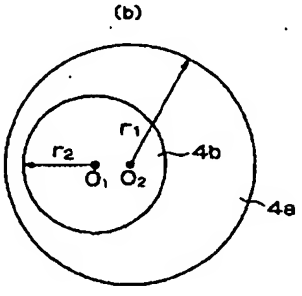
最終頁に続く

(54)【発明の名称】　反射体および反射型液晶表示装置

(57)【要約】
【課題】　広い角度にわたって高い反射効率を得ることができると共にな適度な指向性を有する反射体、並びに、使用者が通常に表示面を見る方向を中心として、広い視野角と充分な明るさを兼ね備えた表示面を有する反射型液晶表示装置を提供する。
【解決手段】　反射体１は、表面に多数の凹部４が形成され、凹部４の内面は、各々半径の異なる２つの球面の一部である周縁曲面４ａと、周縁曲面４ａに囲まれた位置に存する底曲面４ｂとを連続させた面からなり、周縁曲面４ａを形成する球面の半径は、底曲面４ｂを形成する球面の半径より小さいと共に、各々の球面の中心から反射体表面に立てた法線が、互いに異なる直線上に存する。また、本発明の反射型液晶表示装置は、この反射体１を備えたことを特徴としている。



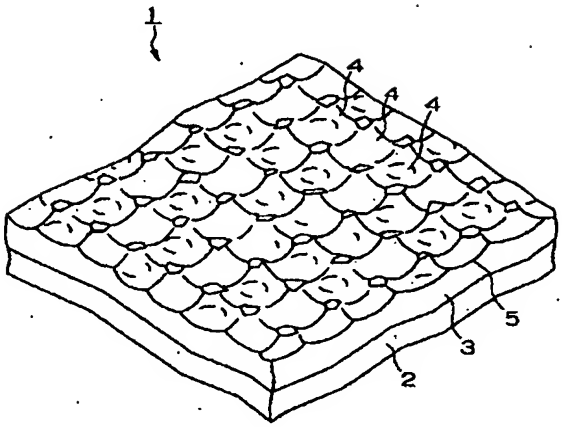



いて説明する図である。

【符号の説明】

1　反射体
2　基板
3　樹脂基材（反射体用基材）
4　凹部
4 a　周縁曲面
4 b　底曲面
5　反射膜
7　母型基材
8　ダイヤモンド圧子
9　反射体形成用母型
1 2　転写型

【図１】

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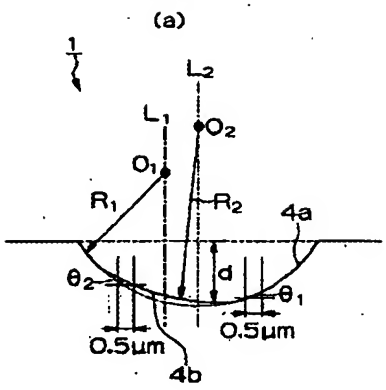


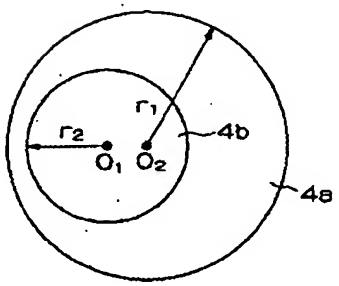


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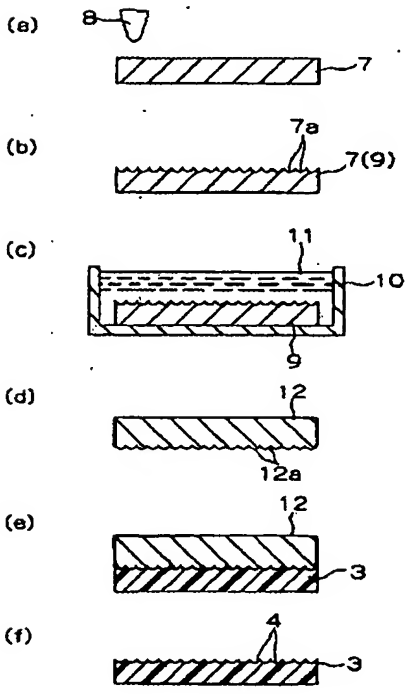


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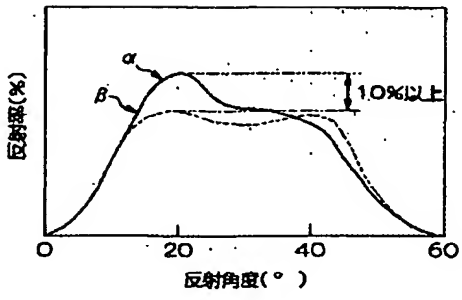

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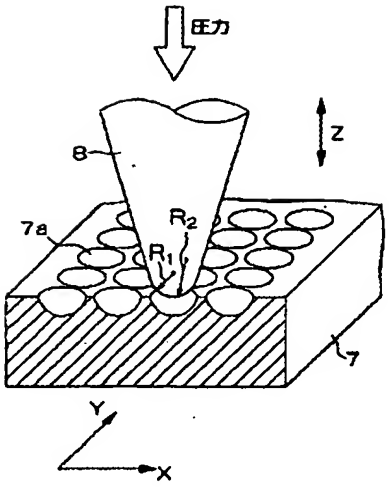


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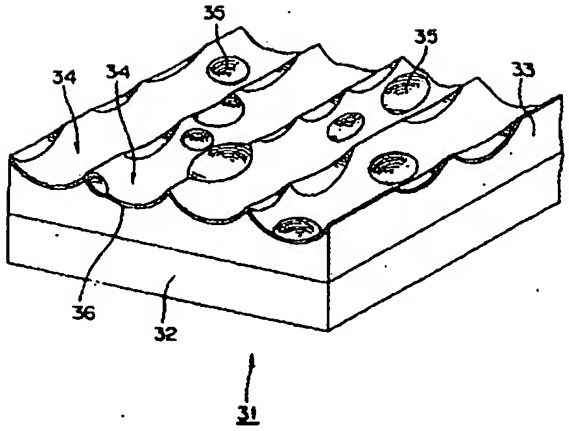


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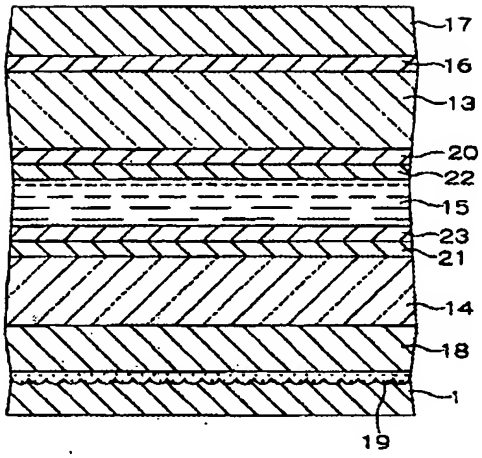


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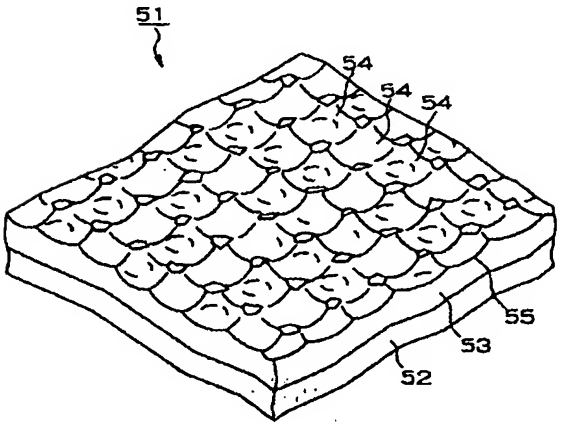


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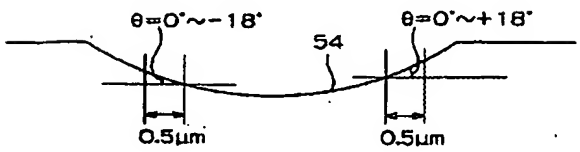


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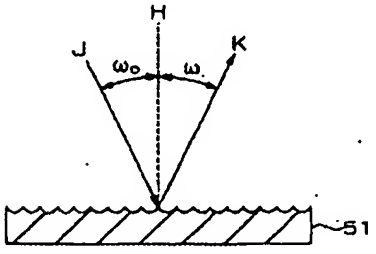

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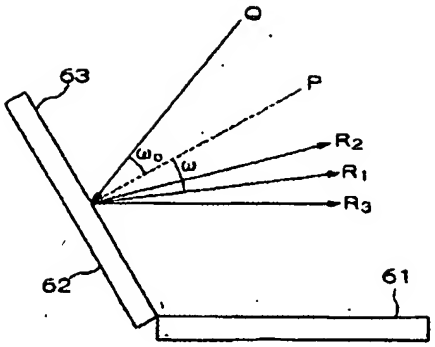


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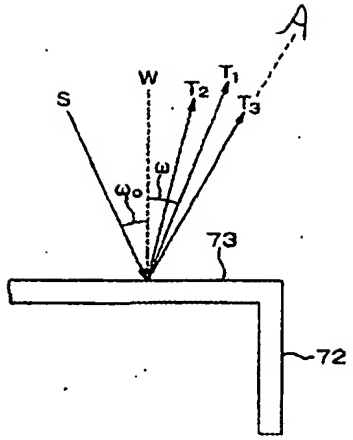


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